Baïkal. One of the Scandinavian species, *Gammarus* (*Pallasea*) *cancelloides*, occurs also in Siberia; another, *Gammarus neglectus*, is scarcely distinct from *Gammarus pulex*, which forms part of the fauna of Lake Baïkal. If we compare the relative number of genera admitted by the two authors, we find a remarkable difference; thus Dr. Dybowsky only admits two genera for his 97 species (*Gammarus* 96 species, *Constantia*, g. n., 1 species), while the four species of M. Sars belong to four different genera. But the genus is something much more subjective than the species; and we have no doubt that, if treated by some authors (Mr. Spence Bate, for example), the Gammaridæ of Lake Baïkal would have furnished materials for the creation of numerous generic groups. *Gammarus cancelloides*, Gerstf., retained by Dr. Dybowsky in its original genus, is the *Pallasea cancelloides* of Spence Bate and Sars.

Dr. Dybowsky explains the reason why he has not dismembered the genus *Gammarus*—namely, that the modifications observed in the different parts of the body present numerous gradations which bind together the most extreme forms into one whole. It may also be observed that the gradual transitions presented by each group of organs or each part have no correlations with those detected in other parts of the organism. In the most widely separated species we find a similar structure of certain parts, which, on the other hand, are very dissimilar in nearly allied species. There is a sort of interlacing of characters which only allows of the establishment of artificial sections, and justifies, it seems to us, the course followed by the author.

The only new genus, which he has named *Constantia*, is distinguished by the structure of its two pairs of antennæ, which are modified so as to form locomotive organs. Their flagella are destitute of sensory organs, and furnished with two rows of long, rigid setæ, which give them a plumose appearance. There is no appendicular flagellum. All the legs are long and slender, especially the second pair of walking-feet (fourth pereiopoda) and the first pair of jumping-feet. The only species belonging to the genus (*C. Branickii*) does not keep at the bottom like the *Gammari*; it is pelagic, and, like other surface Crustacea, has a completely transparent body, so that it can only be perceived in the water in consequence of its black eyes. In reading what the author says of it, it is impossible not to think of *Cystosoma Neptuni*, another almost perfectly transparent Amphipod, which leads a pelagic existence in the Atlantic and Indian Oceans.

Notwithstanding the gradual modifications which they present in their different organs, the Siberian species of the genus *Gammarus* are sufficiently distinct from each other in their general characters; indeed a considerable number are remarkable for their forms, proportions, or ornaments. Some comparatively gigantic species attain a total length of from 118 to 120 millims. (nearly 5 inches); but the small species are much more abundant, and there are even dwarfish forms of which the total length does not exceed 7 or 8 millims.

All depths of the lake have furnished Gammaridæ. The greatest depth to which the author has hitherto carried his dredgings, namely 1373 metres, proved to be as well peopled as the littoral zone, although the number of species was less than at higher levels. However, this comparative poverty seems to be attributable to the fact that the exploration of great depths is attended with great difficulties. Dr. Dybowsky has no doubt that more regular investigations carried on between 500 and 1300 metres would be recompensed by the discovery of new species.

Most of the Gammaridæ of Lake Baïkal which live at small depths are vividly coloured; but with the increase of depth the coloration gradually diminishes, and the species living below 700 metres are more or less whitish in tint. Some varieties, coming from greater depths than those inhabited by the specific type, are distinguished by the paleness of their bodies and eyes, and also, in some cases, by the more elongated and slender form of their locomotive appendages.—*Horæ Soc. Ent. Ross.* Bd. x. Supplement; *Bibl. Univ., Bull. Sci.* 1874, p. 372.

On the Mode in which Amœba *swallows its Food.*

By Prof. J. Leidy.

The author remarked that he had supposed that *Amœba* swallows food by this becoming adherent to the body and then enveloped, much as insects become caught and involved in syrup or other viscid substances. He had repeatedly observed a large *Amœba*, which he supposes to be *A. princeps*, creep into the interstices of a mass of mud and appear on the other side without a particle adherent. On one occasion he had accidentally noticed an *Amœba* with an active flagellate infusorium, a *Urocentrum*, included between two of its finger-like pseudopods. It so happened that the ends of these were in contact with a confervous filament; and the glasses above and below, between which the *Amœba* was examined, effectually prevented the *Urocentrum* from escaping. The condition of imprisonment of the latter was so peculiar that he was led to watch it. The ends of the two pseudopods of the *Amœba* gradually approached, came into contact, and then actually became fused—a thing which he had never before observed with the pseudopods of an *Amœba*. The *Urocentrum* continued to move actively back and forth, endeavouring to escape. At the next moment a delicate film of the ectosarc proceeded from the body of the *Amœba*, above and below, and gradually extended outwardly so as to convert the circle of the pseudopods into a complete sac, enclosing the *Urocentrum*. Another of these creatures was noticed within the *Amœba*, which appeared to have been enclosed in the same manner.

This observation would make it appear that the food of the *Amœba* ordinarily does not simply adhere to the body, and then sink into its substance, but rather, after becoming adherent to or covered by the pseudopods or body, is then enclosed by the active extension of a film of ectosarc around it.—*Proc. Acad. Nat. Sci. Philad.* p. 143.

On the Discovery of true Batrachians in Palæozoic Rocks.

By M. A. Gaudry.

Hitherto Batrachians of existing types seemed to be of recent geological date; most palæontologists believed that these animals did not occur in any formations more ancient than the Tertiaries. There was some ground for astonishment that Vertebrata of such low organization should have come upon the earth so late; and this fact seemed to be in opposition to most of those which palæontology has registered.

I have the honour to bring before the Academy some remains of Batrachians which have just been discovered in Palæozoic rocks. One of them was communicated to me some months since by M. Loustau, engineer on the Northern Railway; it was collected by M. Roche in the bituminous schists of Permian age at Igornay (Saône-et-Loire). A few days ago M. François Delille brought me a slab upon which may be seen seven little Batrachians, which closely resemble those of Igornay. He obtained it at Millery (Saône-et-Loire); and, like the specimen from Igornay, this slab was procured from bituminous schists of Permian age.

I propose to give the Batrachians of Igornay and Millery the name of *Salamandrella petrolei*, to indicate that they have affinities with the salamanders, and to note that they have been buried in deposits from which petroleum is extracted. They are very small: the individual communicated to me by M. Loustau is 30 millims. in length from the outer edge of the muzzle to the extremity of the tail; and the largest of the individuals found by M. Delille is only 35 millims. Notwithstanding their small size, it is probable that they were adult; for the heads, tails, and limbs of the different examples are clearly of the same proportions. The heads are broader than long, triangular, and much flattened: as not one of them is placed on its side, I think that this flattening is natural and not merely the result of the compression of the beds. The orbits are very large and elongated; we see no place for the postorbitals and suprasquamosals, which are so much developed in the Ganocephali. The vertebræ have the centrum ossified: I count 29 of them, viz. 3 cervical, 10 dorsal, 8 lumbar, and 8 caudal, the last very much reduced. The cervical and dorsal vertebræ have arched ribs, much shorter than those of the Ganocephali. I have not been able to perceive any indications of the entosternum and episterna, so remarkable in the Ganocephali and Labyrinthodonts. The fore and hind limbs are nearly of the same size; both are furnished with four digits. I see no traces of scales which could be attributed to the *Salamandrella*; and, indeed, I cannot distinguish around the skeleton any deposit or coloration indicating a hardened skin, which would have persisted longer than the other soft organs.

One cannot help being struck by the resemblance of the little Batrachians of Igornay and Millery to the terrestrial salamanders. Nevertheless their head is a little broader; the bones of their limbs seem to have had the extremities less well-defined; the hind limbs

are directed backward, as in swimming animals. The dorsal and lumbar vertebræ are shorter and more numerous; the lumbar vertebræ bear no ribs; the tail represents only one fifth of the whole length of the body, whilst in the salamanders it equals nearly the half.

The *Salamandrella* is very distinct from the reptiles of the Carboniferous formation which have been described under the names of Labyrinthodonts, Ganocephali, and Microsaurians (such as *Dendrerpeton, Hylerpeton, Hylonomus, Parabatrachus, Anthracherpeton, Urocordylus, Ceraterpeton, Sauropleura, Molgophis*, &c.); but it differs less widely from *Raniceps* (*Pelion*) *Lyelli* from Ohio.

Now that the existence of true Batrachians in the Palæozoic rocks seems to be proved, probably no difficulty will be raised to placing *Raniceps* among those animals, as was proposed by Mr. Wyman in 1858. It is probable that *Raniceps* had a naked skin, and that it possessed no entosternum, episternum, postorbital, or subsquamosal. Nevertheless it cannot belong to the same genus as the fossils of MM. Loustau and Delille; its vertebræ are much more elongated, its frontals are less widened, the supraoccipital is thrown less backwards, and its mandibles are more prolonged. Lastly, the animal from Ohio is three times as large.

In 1844 Hermann von Meyer described, under the name of *Apateon pedestris*, the impression of a reptile found in the Carboniferous formation of Münster-Appel. Notwithstanding the opinion of this talented palæontologist, I think that it belonged to an animal of the group of salamanders; and if it were allowable to form a judgment from an impression so vague as that of *Apateon*, I should be inclined to believe this fossil to be identical with *Salamandrella petrolei*. Thus we should be acquainted with true Batrachians in the Palæozoic rocks of France, the United States, and Germany.

The bituminous schists which contain *Salamandrella petrolei* also include remains of plants, numerous coprolites, and fishes (*Palæoniscus*). M. Loustau has communicated to me a small crustacean derived from them, a series of well-ossified vertebræ of a still unknown reptile, and a fragment of a humerus or femur agreeing in size with that of *Actinodon Frossardi*, a curious Ganocephalous reptile, also collected in the bituminous schist, at Muse, not far from Igornay and Millery, which I brought before the Academy in 1866.

To complete the list of Palæozoic reptiles found in France, I must remark that M. Paul Gervais has described a reptile from the Permian schists of Lodève under the name of *Aphelosaurus*; that learned naturalist has shown that it is very distinct from the Batrachians.—*Comptes Rendus*, February 15, 1875, p. 441.

On the Motive Power of Diatoms. By Prof. J. Leidy.

While the cause of motion remains unknown, some of the uses are obvious. The power is considerable, and enables these minute organisms, when mingled with mud, readily to extricate themselves and rise to the surface, where they may receive the influence of

light and air. In examining the surface-mud of a shallow rain-water pool, in a recent excavation in brick-clay, the author found little else but an abundance of minute diatoms. He was not sufficiently familiar with the diatoms to name the species; but it resembled *Navicula radiosa*. The little diatoms were very active, gliding hither and thither, and knocking the quartz-sand grains about. Noticing the latter, he made some comparative measurements, and found that the *Naviculæ* would move grains of sand as much as twenty-five times their own superficial area, and probably fifty times their own bulk and weight, or perhaps more.—*Proc. Acad. Nat. Sci. Philad.* p. 113.

On the Peripheral Nervous System of the Marine Nematoids.
By M. A. Villot.

The marine Nematoids possess well-characterized organs of sense, consisting:—1, of organs of touch, represented by numerous setæ or papillæ distributed over the whole surface of the body, but particularly abundant round the head and the genital orifice; 2, of an apparatus of vision, composed of two eyes, of rather complex structure, situated on the dorsal surface towards the anterior extremity. The nature of these different organs ought not to be doubtful: but the fact is that their relations with the nervous system have hitherto been very obscure. According to M. Marion * nervous filaments penetrate obliquely "into the midst of the longitudinal muscles to arrive soon at a fusiform, nucleolated cell, itself situated at the base of a cuticular hair, and united with this hair by another nervous thread which terminates at the base of the hair."

M. Bütschli, whose memoir is very recent†, has figured an analogous arrangement; but he states that he has not detected the fusiform cell described by the French writer. He expresses himself as follows:—"Marion states with regard to his *Thoracostoma setigerum*, that a little before the entrance into the setule a fusiform cell is interposed in each of these filaments; with the exception of gangliiform dilatations, which, however, seem to me to have no regular occurrence, I have detected nothing which could be interpreted in favour of this observation."

In presence of these contradictory assertions it became necessary to undertake fresh researches, and to subject those which had been made to the check of the experimental method. Hence my attention was directed most particularly to this point when, in the month of May last, I commenced my investigation of the Helmintha of our shores, in the laboratory of Professor de Lacaze-Duthiers. Now it appears from my numerous observations made at Roscoff upon living individuals, and repeated at Paris upon my preparations, that the two naturalists whom I have just cited have been deceived by false

* "Additions aux recherches sur les Nématoïdes libres du Golfe de Marseille," Ann. Sci. Nat. Zool. 5e série, tom. xix. p. 13, pl. xx. fig. 1.

† Zur Kenntniss der freilebenden Nematoden, insbesondere der des Kieler Hafens. p. 8, pl. iv. fig. 19, *b* (1874).

appearances, due probably to compression, and that they have not seen the true arrangement of the peripheral nervous system of these little creatures. As this arrangement is really very remarkable, I shall now give a short description of it.

Beneath the cuticle, which is smooth or striated, but always structureless, we find a very thin and very refractive granular layer. This layer has neither been figured nor described by M. Marion; but Dr. Charlton Bastian*, in 1866, indicated it very clearly, and even recognized that it contained cells. To investigate it properly it is necessary to macerate entire worms in a mixture of acetic acid, alcohol, glycerine, and water—a mixture which has already rendered me great service in many cases, and the formula of which I have given in my 'Monographie des Dragonneaux.' The marine Nematoids, when immersed in this liquid, quickly became perfectly transparent. We can then see very distinctly that the granular layer situated between the skin and the muscles consists in great part of very fine fatty granules, and that it contains, scattered through it, small stellate cells furnished with a very refractive nucleus.

The relations of these little cellular bodies to the setæ or papillæ are easily ascertained. In a longitudinal section we perceive very distinctly that from the apex of each cell, perpendicularly to the axis of the animal, issues a very delicate thread which, after having traversed the whole thickness of the cuticle, arrives at the base of the papilla and enters it; but each cell also furnishes laterally a certain number of processes which place it in relation with the neighbouring cells; and it is equally easy to ascertain this, if, instead of making a section of the animal, we endeavour to follow the granular layer over a certain portion of its surface, by gradually raising the object-glass of the microscope. The subcutaneous layer of the marine Nematoids, therefore, contains a true network of ganglionic cells, which furnish nervous threads both to the organs of touch and to the organs of vision. This peripheral network is in relation with the central nervous system by means of a plexus, which traverses the muscular layer and unites the ventral nerve with the subcutaneous layer.

These are undoubtedly facts of detail and of delicate observation; but still they are of importance, for they are not isolated. It will suffice for me to recall that various observers have indicated a very analogous network in the Actiniæ, and that I have myself described one exactly similar in *Gordius*. This network arrangement of the ganglionic cells is certainly less rare in the Invertebrata than has hitherto been supposed; and it is probable that it represents in itself the whole of the nervous system of inferior types.—*Comptes Rendus*, February 8, 1875, p. 400.

* "On the Anatomy and Physiology of the Nematoids, parasitic and free," Phil. Trans. 1866, vol. clvi. part 2, pl. xxviii. fig. 36, *d*.

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XXX.—*On the Structure and Systematic Position of the Genus* Cheirolepis. By R. H. Traquair, M.D., F.G.S., Keeper of the Natural-History Collections in the Edinburgh Museum of Science and Art.

[Plate XVII.]

This very interesting genus of Devonian fishes was originally described by the late Prof. Agassiz, in the second volume of his 'Poissons Fossiles,' p. 178, and was then included by him in his family of "Lepidoides." The first step towards the breaking-up of that heterogeneous assemblage was taken by Agassiz himself, in the course of the publication of the same great work, when he constituted the family of Acanthodidæ for the genera *Cheiracanthus*, *Acanthodes*, and *Cheirolepis*; and this classification was retained in his special work on the Fossil Fishes of the Old Red Sandstone. The founder of fossil ichthyology seems, however, to have had but a slight and not very correct conception of the structure of the fishes with which he associated *Cheirolepis*, as may be seen both from his restored figures and his remark that, as the bones which he had been able to distinguish in *Cheirolepis*, "such as the frontal, humerus, temporal, have the same structure as in ordinary osseous fishes," one may conclude "that the Acanthodians in general had a complete osseous system, and not merely a *chorda dorsalis* as in the *Coccostei* and other fishes of the same epoch"*. Subsequent investigations into

* Poissons Fossiles du vieux Grès Rouge, p. 44.